



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

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MEMORANDUM

SUBJECT: United States Environmental Protection Agency Environmental Fate and Effects
Screen of Submitted Studies in Support of the New Registration of
Flupyradifurone (CAS No. 951659-40-8)

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The Environmental Fate and Effects Division (EFED) has completed a new chemical screen of the environmental fate and ecological effects studies submitted by Bayer CropScience in support of a new registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) for the insecticide flupyradifurone (4-[[6-chloropyridin-3-yl)methyl](2,2-difluoroethyl)amino, furan-2(5H)-one, CAS No. 951659-40-8, PC Code not available). This screen included:

- Review of proposed labels to verify that all information needed to complete an ecological risk assessment is available;
- A check of the submission to ensure that all studies triggered by the proposed use patterns under title 40, part 158 of the Code of Federal Regulations (40 CFR part 158¹) are included in the package for the parent compound; and
- An evaluation as to whether each study has any significant deficiencies.

¹ http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&sid=91d00bcd5d80100c8f6bc2682062b77&tpl=/ecfrbrowse/Title40/40cfr158_main_02.tpl

Please note that this screen is not intended to be a comprehensive evaluation of the overall quality of specific studies, but as an inspection as to whether a reasonably complete package has been submitted. Also, studies that pass the screen are not automatically assured of acceptance in support of their respective data requirement. Additionally, many of the submitted studies are not standard data requirements in EFED but are required in other countries. These studies were not reviewed for completeness by EFED.

Use Pattern and Label Information

Flupyradifurone is a broad spectrum systemic butenolide insecticide that is proposed for use on foliage or soil via air (including airblast), ground, or chemigation on a variety of agricultural crops and crop groups (**Table 2**). It is also proposed for use as a seed treatment for soybeans. The products proposed for registration in the United States (U.S.) are summarized in **Table 1** and all are flowable materials and only contain the one active ingredient. Most uses have the same proposed maximum single and yearly application rates of 0.18 lbs active ingredient per acre (lbs a.i./A) and 0.37 lbs a.i./A per year. A few crops (fruiting vegetables, cucurbit vegetables, citrus fruit, small fruit and vine climbing group) have a proposed maximum single application rate of 0.37 lbs a.i./A and maximum yearly application rate of 0.37 lbs a.i./A. The number of proposed applications is not specified for any use and retreatment intervals range from “not specified” to 10 days.

Table 1. Summary of proposed products in the United States for flupyradifurone

Product Name	Percent Flupyradifurone	Formulation	Comments
Flupyradifurone TC	98.36	Not specified	For formulation of end use products
BYI 02960 480 FS	40.68	Flowable	Commercial soybean seed treatment
Sivanto™ 200 SL	23.4	Flowable	For use on foliage or soil for a variety of crops

Table 2. Summary of proposed uses for flupyradifurone

Use Site	Single App. Rate in lbs. ai/A (kg ai/ha)	# of App	Seasonal App. Rate* lbs. ai/A (kg ai/ha)	Retreatment Interval (days)	PHI (days)	Geographic Restrictions	Comments	Pest
Soybean Seed	0.045 – 0.068 mg a.i./seed or 30-45 g a.i./100 kg seed	NS	0.365 (0.409)	NS	NS	--	Seed Treatment	aphids, leaf beetle, thrips
Crop Group 15: Cereal Grains (except Rice) ¹	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	7	7 forage and sweet corn	--	Foliar	aphids, leaf hoppers, whiteflies
					21 dried grain	--		
Cotton	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	10	14	--	Foliar	aphids, fleahoppers, whiteflies
Nongrass Animal Feeds (Forage, Fodder, Straw, Hay) ²	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	10	7 forage, silage, hay or seed of alfalfa	--	foliar	aphids, leafhoppers, threecornered alfalfa hopper, whiteflies, tarnished plant bug, western plant bug
					14 all others	--		
Peanut	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	10	7	--	foliar	aphids, leafhoppers, threecornered alfalfa hopper, whiteflies
Root Vegetables (except Sugarbeet) ³	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	10	7	--	foliar	aphids, leafhoppers, whiteflies
Tuberous and Corm Vegetables ⁴	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	7	7	West of MS river		aphids, leafhoppers, whiteflies, Colorado potato beetle, potato psyllid
Leafy Vegetables (except <i>Brassica</i>) ⁵	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	7	1	--	foliar	aphids, leafhoppers, whiteflies

Use Site	Single App. Rate in lbs. ai/A (kg ai/ha)	# of App	Seasonal App. Rate* lbs. ai/A (kg ai/ha)	Retreatment Interval (days)	PHI (days)	Geographic Restrictions	Comments	Pest
Brassica (Cole) Leafy Vegetables ⁶	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	7	1	--	foliar	aphids, leafhoppers, whiteflies
Legume Vegetables (Succulent or Dried) ⁷	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	10	7 forage, leaves, vines, pods, cutting for hay or seed	--	foliar	aphids, leafhoppers, whiteflies
					21 dry soybean seed	--	foliar	
Fruiting Vegetables ⁸	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	7	1	West of MS river	foliar	aphids, leafhoppers, whiteflies
	0.27 - 0.37 (0.31 - 0.41)	NS	0.365 (0.409)	NS	45	--	soil, chemigation to root zone, injection below seed line, potting hole drench at transplanting, post transplant drench following setting and covering	aphids, leafhoppers, potato psyllid, whiteflies
Cucurbit Vegetables ⁹	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	7	1	West of MS river	foliar	aphids, leafhoppers, squash bug, whiteflies
	0.27 - 0.37 (0.31 - 0.41)	NS	0.365 (0.409)	7	21	--	soil, chemigation to root zone, injection below seed line, potting hole drench at transplanting, post transplant drench following setting and covering	aphids, leafhoppers, whiteflies
Hop	0.09 - 0.14 (0.10 - 0.15)	NS	0.14 (0.15)	NS	21	--	Foliar	aphids
Citrus Fruit ¹⁰	0.27 - 0.37 (0.31 - 0.41)	NS	0.365 (0.409)	10	30	--	Soil, chemigation into root zone through low pressure drip, trickle, micro-sprinkler; basal drench in sufficient water to move into root zone	Aphids, Asian citrus psyllid, whiteflies
	0.09 - 0.18 (0.10 - 0.20)	NS		10	1	--	Foliar	Asian citrus psyllid, citricola scale, citrus thrips, whiteflies

Use Site	Single App. Rate in lbs. ai/A (kg ai/ha)	# of App	Seasonal App. Rate* lbs. ai/A (kg ai/ha)	Retreatment Interval (days)	PHI (days)	Geographic Restrictions	Comments	Pest
Pome Fruit ¹¹	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	10	14	--	Foliar, combine with horticultural oil for early season applications targeting San Jose scale and Pear psylla	Aphids, leafhoppers, pear psylla, San Jose scale
Bushberry ¹²	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	7	3	--	Foliar	Aphids, blueberry thrips, blueberry maggot
Low Growing Berry (including Cranberry) ¹³	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	10	0	--	Foliar	Aphids, blueberry thrips, whiteflies, blueberry maggot
Small Fruit Vine Climbing (except Fuzzy Kiwifruit) ¹⁴	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	10	0	--	Foliar	Leafhoppers, vine mealybug
	0.27 - 0.37 (0.31 - 0.41)	NS		NS	30	--	Soil, chemigation into root-zone through low pressure drip, trickle, micro-sprinkler or equivalent equipment; basal drench in sufficient water to move into root zone.	Leafhoppers, vine mealybug
Tree Nut ¹⁵	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	14	7	--	Foliar	Aphids, whiteflies
Prickly Pear/Cactus pear ¹⁶	0.09 - 0.18 (0.10 - 0.20)	NS	0.365 (0.409)	14	7	--	Foliar, ground only	Aphids, whiteflies

App=application; PHI=preharvest interval; lbs ai/A=pounds active ingredient per acre; kg ai/ha=kg active ingredient per hectare; NS=not specified;

*Seasonal application rate is for application of the product not the active ingredient.

¹ Crop Group 15 (Cereal Grains) allows for use on barley, buckwheat, corn (including field corn, seed corn, sweet corn, and popcorn), millet (pearl and proso), oats, rye, teosinte, triticale, and wheat

² Nongrass animal feeds (forage, fodder, straw, and hay) includes uses for crop group 18 and the following crops: alfalfa, clover, kudzu, leepedza, lupin, milk vetch, sainfoin, trefoil, velvet bean, and vetch.

³ Root Vegetables (except sugarbeet) include Crops of Subgroup 1B including: garden beet, edible burdock, carrot, celery root, chervil, chicory, ginseng, horseradish, parsley, parsnip, radish, oriental radish, rutabaga, salsify (black, oyster plant, Spanish), skirret, turnip.

⁴ Tuberous and corm vegetables includes crops of crop subgroup 1C including: Aracacha, arrowroot, artichoke (Chinese and Jerusalem), Canna, Cassava (bitter and sweet), Chayote (root), Chufa, Dasheen (taro), ginger, potato, sweet potato, tanier (cocoyam), tumeric, yam bean (jicama, manioc, pea, true yam.

⁵ Leafy vegetables (except *Brassica*) include crops of crop group 4 including Amaranth (leafy amaranth, Chinese spinach, tampala), Arugula (Roquette), Cardoon, Celery, Celtuce, Chervil, Chinese celerey, Chrysanthemum (edible-leaved and garland), corn salad, cress (garden upland, yellow, rocket, winter),

dandelion, dock (sorrel), endive, florence fennel (sweet anise, sweet fennel, finocchio), lettuce (head and leaf), orach, parsley, purslane [garden and winter), radicchio (red chicory), rhubarb, spinach (including New Zealand and vine (Malabar spinach, Indian spinach)], Swiss chard, and Taro leaves.

⁶ *Brassica* (cole) leafy vegetables include crops of crop group 5 including: broccoli, broccoli raab (rapini), Brussels sprouts, cabbage, cauliflower, cavalo broccolo, Chinese broccoli (gai lon), Chinese cabbage (bok choy), Chinese cabbage (napa), Chinese mustard cabbage (gai choy), collards, kale, kohlrabi, mizuna, mustard greens, mustard spinach, rape greens, turnip greens.

⁷ Legume vegetables (succulent or dried) include crops of crop group 6 including edible podded and succulent pea and bean and dried shelled pea and bean, bean (grain, lupin, sweet lupin, white lupin, and white sweet lupin), field bean, kidney bean, lima bean, navy bean, pinto bean, runner bean, tepary bean, wax bean, adzuki bean, asparagus bean, blackeyed pea, catjang, Chinese longbean, cowpea, Crowder pea, moth bean, mung bean, rice bean, southern pea, urd bean, yardlong bean, pea, dwarf pea, edible-pd pea, english pea, field pea, garden pea, green pea, snow pea, sugar snap pea, fava bean, chickpea, guar, jackbean, lablab bean, lentil, pigeon pea, soybean (immature seed), and sword bean), soybean, and other beans.

⁸ Fruiting vegetables include crops of crop group 8-10 including: cocona, eggplant (African, pea and Scarlet eggplants), garden huckleberry, goji berry, groundcherry, martynia, naranjilla, okra, pepper (all, bell, nonbell, hot, sweet, etc.), roselle, sunberry, tomatillo, tomato (including bush, currant, tree) including cultivars, varieties and/or hybrids of these commodities.

⁹ Cucurbit vegetables include crops of crop group 9 including: Chayote (fruit), Chinese waxgourd (Chinese preserving melon), citron melon, cucumber, gherkin, gourd (edible, hyotan, cucuzza, hechima, Chinese okra), *Momordica* spp. (includes balsam apple, balsam pear, bitter melon, Chinese cucumber), muskmelon (hybrids and cultivars of cucumis melo including true cantaloupe, cantaloupe, casaba, crenshaw melon, golden pershaw melon, honeydew melon, honey balls, mango melon, Persian melon, pineapple melon, Santa Claus melon, snake melon), pumpkin, squash (includes summer squash types such as crookneck squash, scallop squash, straightneck squash, vegetable marrow, and winter squash types such as acorn squash, butternut squash, calabaza, cushaw, hubbard squash, spaghett squash), Watermelon (includes hybrids and/or varieties *Citrulus lanatus*).

¹⁰ Citrus fruit include crops of subgroup 10-10 including: calamondin, cistrus citron, citrus hybrids (*Citruss spp.*, *Eremocitrus spp.*, *Fortunella spp.*, *Microcitrus spp.*, and *Poncirus spp.*), grapefruit (including Japanese Summer), kumquat, lemon, lime (sweet, Australian desert, Australian finger, Australian round, brown river finger, mount white, New Guinea wild, Russell River, Tahiti), mandarin (Mediterranean, satsuma), orange (sour, sweet, tachibana, trifoliate), pummelo, tangelo, tangerine [includes tangerine (mandarin or mandarin orange), clementine, Mediterranean mandarin, satsuma mandarin, tangelo, tangor, cultivars, and varieties], tangor, unique fruit and cultivars, varieties and/or hybrids of these commodities.

¹¹ Pome fruit includes crops of crop group 11 including apple, azarole, crabapples (Chinese apple, Chinese crab apple, Chinese flowering apple, crab apple cutleaf crab apple, Florentine crab apple, Hall crab apple, Iowa crab apple, Japanese crab apple, Kai do crab apple, Manchurian crab apple, Paradise apple, Sargent's crab apple, Siberian crab apple, Soulard crab apple, Southern crab apple, Sweet crab apple, Tea crab apple, Toringa crab apple, Western Crabapple, Yunnan crab apple, and varieties and/or hybrids of these), loquat, mayhaw, medlar, pear, Asian pear, quince, Chinese quince, Japanese Quince, tejocote, and cultivars, varieties and/or hybrids of these.

¹² Bushberry includes crops of subgroup 13-07B including: aronia berry, blueberry (*Vaccinium* spp. – highbush, lowbush, and cultivars and/or hybrids of these [=all blueberry species]), Chilean guava, currant (black, buffalo, native, and red), elderberry, European barberry, gooseberry (*Ribes* spp.), highbush cranberry, honeysuckle (edible), huckleberry, jostaberry, juneberry, lingonberry, salal, sea buckthorn, and cultivars, varieties and/or hybrids of these.

¹³ Low growing berry includes crops of crop subgroup 13-07-G including: bearberry, blueberry (lowbush), cloudberry, cranberry, lingonberry, muntries, partridgeberry, strawberry, plus cultivars, varieties, and/or hybrids of these.

¹⁴ Small fruit vine climbing (except fuzzy kiwifruit) includes crops of subgroup 13-07F including: Amur river grape, goosberry (*Ribes* spp.), grape, kiwifruit (hardy, only), maypop, Schisandra berry, and cultivars, varieties, and/or hybrids of these.

¹⁵ Tree nut includes crops of crop subgroup 14 (except almond) including: beech nut, brazil nut, butternut, cashew, chestnut, chinquapin, hazelnut (filbert), hickory nut, macadamia nut (bush nut), pecan, pistachio, walnut [including black and English (Persian) walnuts)].

Label Clarification Needed

Below is a list of information needed in order to estimate environmental exposure from the proposed uses of flupyradifurone. Please provide clarification of the uses as described on the specified labels. If the information is not specified on the label, conservative assumptions on use will be made in modeling potential exposure to flupyradifurone.

All labels:

- Specify on the label the nature of the formulation (*e.g.*, emulsifiable concentrate, soluble concentrate)

BYI 02960 480 FS

For seed treatments, the following information is needed on the label:

- Number of seeds per pound
- Maximum number of treated seeds that may be applied per acre or number of pounds of treated seed per acre
- Minimum planting depth

SivantoTM 200 SL

- The label should specify a maximum number of applications for each crop.
- Under tuberous and corm vegetables and fruiting vegetables the label states: “west of Mississippi River”. EFED is not clear on what this means (*e.g.*, can the product be used only west of the Mississippi River, or is its use prohibited west of the Mississippi River). The label needs to clarify the intent of this language. In the absence of additional information, EFED would assume that the product could be used across the United States.
- Retreatment intervals should be specified for soil applications to fruiting vegetables, foliar applications to hops, and soil applications to the “small fruit climbing” group.
- As the maximum application rates are provided on a seasonal basis, the label should specify the maximum number of seasons per year that the chemical may be applied to crops that have more than one growing cycle per year. Alternatively, the maximum application rates on a yearly basis could be provided.

Environmental Fate

After screening, it is EFED’s judgment that all of the provided fate studies are reviewable. However, some of these studies may not be fully acceptable. Specific deficiencies with individual studies are discussed further below. **Table 3** summarizes the new chemical screening summary of the environmental fate data for flupyradifurone.

- 1) Many studies were conducted on foreign soils. Comparison of these foreign soils with comparable U.S. soils using the World Resources Base (WRB) soil classification system is needed (USEPA, 2011). This information is needed to determine whether the submitted studies will be useful to fulfill the Office of Chemical Safety and Pollution Prevention

- (OCSPP) Guidelines² on fate, transport and transformation. These include studies submitted in support of soil metabolism, adsorption/desorption, and field dissipation.
- 2) The test on photodegradation in water (OCSPP Guideline 835.2240³) was conducted using a parent material with only the furanone ring radio-labeled. When a compound has multiple rings, studies are usually conducted with each ring labeled so that the formation and decline of degradates associated with any ring may be characterized. More information is needed on the identity of degradates associated with the pyridine ring that could occur due to photodegradation of flupyrifurone in water.
 - 3) Many studies are available examining aerobic metabolism of flupyrifurone in foreign soils (OCSPP Guideline 835.4100⁴). Some of these studies were stopped at 120 days, prior to loss of 50% of the parent. When this occurs, a complete analysis of the formation and decline of the parent and degradates is not achieved in the study. Some of the studies were conducted for sufficient duration to allow greater than 50% loss of parent, but these studies were not conducted on U.S. soils. Comparison of the studies conducted with foreign soils would help in determining whether data were adequate to fulfill the guideline recommendations. The need for additional data based on presence of unextracted residues and complete information on formation and decline will be determined as the review progresses.
 - 4) Aerobic aquatic metabolism studies (OCSPP 835.4300⁵) should have been extended to one year to fully characterize the decline of parent and formation and decline of degradates.
 - 5) Additional data are recommended for a better understanding of adsorption/desorption (OCSPP Guideline 835.1230⁶) of flupyrifurone. The current submission does not include sorption data for an aquatic sediment, as recommended in the guideline. Additionally, comparison of foreign soils to U.S. soils using the World Resources Base (WRB) soil classification system is needed to determine whether data are available on four soils comparable to U.S. use site soils (USEPA, 2011).
 - 6) Terrestrial field dissipation studies (OCSPP Guideline 835.6100⁷) are recommended on cropped plots, as well as on bare ground sites when plants are an important factor in controlling field dissipation. Field dissipation studies should be completed on representative use sites for proposed uses in the U.S., or a rationale should be provided as to why such studies were not conducted. Currently, terrestrial field dissipation studies on flupyrifurone are available for bare ground sites only. Submitted studies must employ associated environmental chemistry methods that have undergone independent laboratory validation for each matrix analyzed (*e.g.*, soil and plant material). See *NAFTA Guidance Document for Conducting Terrestrial Dissipation Studies* (http://www.epa.gov/oppefed1/ecorisk_ders/terrestrial_field_dissipation.htm) for more information on the needs for terrestrial field dissipation studies.
 - 7) An aquatic field dissipation study (OCSPP Guideline 835.6200⁸) was not submitted to support the proposed use on cranberries. Aquatic field dissipation studies are recommended for uses where the pesticide may be directly applied to water, or where water is used to flood the field after pesticide application (see 40CFR158 § 158.1300 Environmental fate data

² http://www.epa.gov/ocspp/pubs/frs/publications/Test_Guidelines/series835.htm

³ <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0152-0012>

⁴ <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0152-0038>

⁵ <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0152-0039>

⁶ <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0152-0006>

⁷ <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0152-0040>

⁸ <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0152-0041>

requirements table⁹). The study should employ an associated environmental chemistry method that has undergone an independent laboratory validation. The registrant should clarify whether they intend to support the proposed use on cranberries.

Other deficiencies may be noted upon thorough review of the submitted studies.

Ecological Effects

After screening, it is EFED's judgment that all of the provided ecological effects studies are reviewable. However, some of these studies may not be fully acceptable. **Table 3** summarizes the new chemical screening summary of the ecological effects data for flupyradifurone. Major omissions include the lack of the full suite of algae/cyanobacteria toxicity tests, and the lack of test information to calculate a chronic estuarine/marine fish toxicity endpoint. Many aquatic studies were carried out as static tests, and the majority of these tests appear to have maintained stable test substance concentrations throughout the test. Please note that honeybee semi-field/field studies and residue studies related to pollinators were not included in this screening.

⁹ <http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=e806ca39b69c8e03c0b9335da3c06836&rgn=div8&view=text&node=40:25.0.1.1.9.12.1.1&idno=40>

Table 3. Summary of the new chemical screen of the environmental fate data for flupyradifurone

Guideline	Test Substance	Endpoints	Comments	Reviewable (Yes/No)	Additional Data Needed?	MRID Citation
Hydrolysis 835.2120	Parent	Stable, pH 4, 7, 9	50°C, 5 days, sterility lost in one chamber at one time point	Yes	No	48843667 (Mislankar and Woodard, 2011)
Photodegradation in Water 835.2240	Parent	SFO $T_{1/2}$ = 1.75 days (33°N, Arizona)	Only furanone ring labeled.	Yes	Yes, degradates associated with unlabeled ring are unknown.	48843669 (Hall, 2011)
	Parent	SFO $T_{1/2}$ = 3.8 days (35°N, Japan)	Only furanone ring labeled	Yes		48843670 (Hall, 2011)
	Parent	Quantum Yield	Nonguideline study	Yes		48843668 (Heinemann, 2011)
Photodegradation on Soil 835.2410	Parent	SFO $t_{1/2}$ = 358-405 days (Los Angeles, CA)	No issues were identified at this time.	Yes	No	48843672 (Menke and Unold, 2011)
Photodegradation in Air 835.2370	Parent	$T_{1/2}$ = 4.37 hours (estimated)	No laboratory data. Estimates based on computer modeling.	Yes	No	48843671 (Hellpointner, 2010)
Aerobic Soil Metabolism 835.4100	Parent	SFO $t_{1/2}$ = 63.4 days 52.4 days 120.0 days 56.4 days	120 day experiment 24 to 50% present as parent at study termination. Unextracted residues reached 17%. All German soils. Pyridinylmethyl group labeled. Rings not labeled.	Yes	Comparison of foreign soils to U.S. soils using the World Resources Base (WRB) soil classification system would be very helpful for those studies conducted on foreign soils (USEPA, 2011). Need at least 4 soils that are comparable to U.S. soils use sites with at least 50% loss of parent occurring. This is likely available in the dataset but we are unable to make this determination without the comparisons to U.S. soils. The need for additional data based on presence of unextracted residues	48843674 (Menke, 2011) 48843675 (Sur and Dorn, 2012)
	Parent	SFO $t_{1/2}$ = 70.6 days 40.5 days 96.3 days 55.1 days	120 day experiment 20 to 45% present as parent at study termination. Furanone ring labeled. Unextracted residues up to 34%. German soils.	Yes		48843676 (Menke, 2011) 48843678 (Sur and Dorn, 2012)
	Parent	SFO $t_{1/2}$ = 228 days 65.7 days	Furanone labeled. Study terminated at 120 days and 30 and 67% remained as parent. 16-30% unextracted residues	Yes		48843677 (Ripperger, 2011)

Guideline	Test Substance	Endpoints	Comments	Reviewable (Yes/No)	Additional Data Needed?	MRID Citation
			formed. U.S. soils.		and complete information on formation/decline will be determined as the review progresses.	
	Parent	SFO $T_{1/2}$ = 38.6 days 74.5 days 43.0 days	German soils. 120 day experiment 23 – 40% remained as parent at end of study. Unextracted residues reached 18%. Ethyl group labeled. Rings not labeled. German soils. Pyridine ring labeled also.	Yes		48843679 (Menke and Unold, 2011) 48843680 (Sur and Dorn, 2012)
	Parent	SFO $t_{1/2}$ = 43.4 days	120 day experiment, 23% remained as parent. German soil. Unextracted residues reached 17%.	Yes		48843681 (Menke and Unold, 2011) 48843684 (Sur and Dorn, 2012)
	Parent	SFO $t_{1/2}$ = 211 days 62.1 days	U.S. soils. Unextracted residues reached maximum of 11-25%. 120 day experiment, 40-67% remained as parent at end of study.	Yes		48843682 (Shepherd, 2011)
	Parent	SFO $t_{1/2}$ = 203 days 142 days 127 days 371 days	Brazilian soils. Pyridine ring labeled. 120 day experiment, 54 – 72% remained as parent.	Yes		48843683 (de Souza, 2012)
	6-CNA	SFO $t_{1/2}$ = 2.9 days 2.2 days 5.3 days	U.K soils. Unextracted residues up to 21%	Yes		48843685 (Sur and Dorn, 2012)
Anaerobic Soil Metabolism 835.4200 (162-2)	Parent	Minimal loss of parent	Unextracted residues reached a maximum of 30% in one soil. 3 different labels	Yes	Comparison of foreign soils to U.S. soils using the World Resources Base (WRB) soil classification system would be very helpful for	48843686 (Menke and Unold, 2012)
	Parent	Minimal loss of	U.S. soil. Unextracted residues	Yes		48843687

Guideline	Test Substance	Endpoints	Comments	Reviewable (Yes/No)	Additional Data Needed?	MRID Citation
		parent	reached 19% and remained constant through anaerobic phase. ~10% loss of parent during anaerobic phase, 1 soil. Pyridine labeled.		those studies conducted on foreign soils (USEPA, 2011). Data on four soils comparable to U.S. soils are recommended. However, as we are observing essential stability in the three soils examined, data on an additional soil is not requested at this time.	(Mislankar and Woodard, 2012)
	Parent	No loss of parent	U.S. soil. Pyridine labeled. Only followed for 60 days under anaerobic conditions. Unextracted residues reached 15%.	Yes		48843688 (Woodard, 2012)
Aerobic Aquatic Metabolism 845.4300 (162-4)	Parent	SFO $T_{1/2}$ = 193.1 days 246.9 days	Pyridine ring labeled only. Sediments from Germany. Unextracted residues reached 25%. 64 and 71% remained as parent at end of 120 day study.	Yes	Yes. Study should have been extended to 1 year to fully characterize formation and decline curve. Also, degradates associated with unlabeled ring could be missed.	48843690 (Hellpointner and Unold, 2012)
	Parent	SFO $T_{1/2}$ = 202-208 days 246 – 286 days	Furanone ring labeled, ethyl group labeled. Systems from Germany. Unextracted residues reached 27%. >67% remaining as parent at end of 120 day experiment.	Yes		48843692 (Menke and Unold, 2012)
		SFO $T_{1/2}$ = 109 days 567 days	Unextracted residues were high (16%) in one test system. Both systems had a couple of unextracted residue outliers at 40 and 55%.	Yes		48843691 (Hellpointner and Unold, 2012)
Anaerobic Aquatic Metabolism 835.4400 (162-3)	Parent	SFO $T_{1/2}$ = >1000 days 415 days	Unextracted residues reached 12% in one system. Two U.S. pond systems. Pyridine ring labeled. Loss of parent in one sediment could be due to presence of unextracted residues. Studies were only conducted for 102 days.	Yes	Evidence indicates that compound is stable to anaerobic metabolism. Therefore, additional data are not recommended at this time.	48843689 (Xu, 2012)
Adsorption/Desorption	Parent	K_F = 2.07 – 3.82 mL/g	4 German soils. Identity confirmed at highest test	Yes	Data are recommended for measurement in one aquatic	48843662 (Menke and

Guideline	Test Substance	Endpoints	Comments	Reviewable (Yes/No)	Additional Data Needed?	MRID Citation
835.1230 And Leaching Studies 835.1240			concentration only.		sediment. Additionally, comparison of foreign soils to U.S. soils using the World Resources Base (WRB) soil classification system is needed to determine whether data are available on four soils comparable to U.S. use site soils (USEPA, 2011).	Telscher, 2008)
	Parent	K _F = 0.597 – 2.512 mL/g	2 U.S. soils. Identity of test substance not confirmed. Aerobic soil half-lives suggest minimal loss in 24 hours.			48843663 (Stroeck, 2010)
	Parent	K _d = 0.7 – 38.8 L/kg	4 brazilian soils.			48843664 (de Souza, 2012)
	DFA	K _F = 0.028 – 0.368 mL/g	5 German soils.			48843665 (Menke and Unold, 2011)
	Parent		Soil column leaching study			48843666 (de Souza, 2012)
Laboratory Volatility 835.1410 (163-2)	No data submitted					
Field volatility 835.8100 (163-3)	No data submitted					
Terrestrial Field Dissipation 835.6100 (164-1)	BYI 02960 200 SL	SFO T _{1/2} = 125 days	Bare ground Tulare County, CA		Terrestrial field dissipation studies are recommended on cropped plots when plants may be an important route of dissipation as well as bare ground sites. Field dissipation studies should be completed on representative use sites for the range of proposed uses in the United States. Currently, studies are only available for bare ground	48843693 (Lenz, 2012)
	BYI 02960 200 SL	SFO T _{1/2} = 77.1 days	Bare ground, Florida	Yes		48843694 (Lenz, 2012)

Guideline	Test Substance	Endpoints	Comments	Reviewable (Yes/No)	Additional Data Needed?	MRID Citation
	BYI 02960 200 SL	SFO $T_{1/2}$ = 152 days	Bare ground, Blained County, Idaho	Yes		48843695 (Lenz, 2012)
	BYI 02960 200 SL	SFO $T_{1/2}$ = 234days 95 days 83 days	3 bare ground plots in Canada	Yes		48843696 (Harbin, 2012)
	BYI 02960 200 SL	SFO $T_{1/2}$ = 105days 83.0days 28.8days 45.7 days 55.6 days	Bare ground sites in United Kingdom, France, Italy, Spain, and two sites in Germany. Sites were planted with grass.	Yes		48843697 (Heinemann, 2011)
Aquatic Sediment Dissipation 835.6200 (164-2)	Parent	SFO $T_{1/2}$ = 95.1 days	Microcosm studies, 6 polycarbonate cylinders treated in pond. Germany	Yes	Yes, an aquatic field dissipation study is needed to support the proposed use on cranberries. The study should include environmental chemistry methods for water with an associated independent laboratory validation.	48843673 (Bruns, 2012)
Forestry Dissipation 835.6300	No data submitted					
Fish Bioconcentration 850.1730	No data submitted					

NA: Not applicable; DFA=Sodium difluoroacetate [sodium salt]/difluoroacetic acid [free acid]; 6-CNA=6-chloronicotinic acid; SFO=single first order

Table 4. Summary of the new chemical screen of the ecological effects data for flupyradifurone

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
850.2100	Avian acute oral toxicity, waterfowl	None	N/A	N/A	N/A	N/A	NO: only one representative of waterfowl <u>or</u> upland game bird required
	Avian acute oral toxicity, upland game bird species, TGAI	48843715 (Fredericks and Stoughton, 2011)	BYI 02960 (96.2%)	Northern Bobwhite Quail (<i>Colinus virginianus</i>)	14-day LD ₅₀ 232 mg ai/kg-bw	Definitive test; only two test doses where mortality was between 0 and 100%; NOAEL based on body weight 100 mg ai/kg-bw.	POSSIBLE: 850. 2100 states that at least three doses should cause mortality between, but not including, 0% and 100%.
	Avian acute oral toxicity, passerine species, TGAI	48843716 (Christ and Fredericks, 2011)	BYI 02960 (96.2%)	Canary (<i>Serinus canaria</i>)	14-day LD ₅₀ 330 mg ai/kg-bw	Definitive test; no regurgitation observed; study author endpoint may not be appropriate as 50% mortality was observed at the 175 mg ai/kg-bw level; some sublethal effects observed at all test levels; body weight and feed consumption do not appear to have been affected	POSSIBLE: responses do not immediately bracket the point estimate of concern (<i>i.e.</i> , there were no doses with <5 mortalities).
	Avian acute oral toxicity, additional species, TGAI	48843717 (Barfknecht and Wilkens 2011)	BYI 02960 (96.2%)	Chicken (<i>Gallus gallus</i>)	28-day LD ₅₀ >2000 mg ai/kg-bw	Submitted under OECD 223 guideline; limit test; an almost complete cessation of food consumption observed in all dosed birds; two birds were sacrificed due to animal welfare reasons and the study ended on the same day birds were sacrificed, on day 28 – this points to potential severe effects on food consumption	Pronounced sublethal effects during limit test typically warrant definitive testing; however this is not a preferred test species and data from other species are already available.
	Avian acute oral toxicity, TEP	48844512 (Stoughton and Christ, 2012)	BYI 02960 SL200 (17.1%)	Northern Bobwhite Quail (<i>Colinus virginianus</i>)	14-day LD ₅₀ 431 mg ai/kg-bw (corrected for formulation)	Definitive test; 10 birds per test level	

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
	Avian acute oral toxicity, TEP	48844513 (Barfknecht and Wilkens 2012)	BYI 02960 SL200 (17.1%)	Chicken (<i>Gallus gallus</i>)	14-day LD ₅₀ >342 mg ai/kg-bw (corrected for formulation)	Limit test with 5 birds exposed to test substance and 10 birds in control group; observation period of 21 days; transitory effects on food consumption	This is not a required test; however, there were fewer animals per test level than typical for an acute oral toxicity study; note: the limit dose was 2000 mg formulation/kg-bw
850.2200	Avian dietary toxicity, waterfowl species, TGAI	48843719 (Fredericks et al., 2010)	BYI 02960 (96.2%)	Mallard Duck (<i>Anas platyrhynchos</i>)	5-day LC ₅₀ >4741 mg ai/kg-diet (825 mg ai/kg-bw)	Definitive test; reduced body weight and growth at ≥ 2238 mg ai/kg-diet and feed consumption at 4741 mg ai/kg-diet only	
	Avian dietary toxicity, upland game bird, TGAI	48843718 (Stoughton and Lam, 2010)	BYI 02960 (96.2%)	Northern Bobwhite Quail (<i>Colinus virginianus</i>)	5-day LC ₅₀ >4876 mg ai/kg-diet (278 mg ai/kg-bw)	Definitive test; reduced body weight and feed consumption at concentrations ≥ 2075 mg ai/kg-diet and on weight gain (growth) at concentrations ≥ 1133 mg ai/kg-diet	
850.2300	Avian reproduction, waterfowl species, TGAI	48843721 (Stoughton et al., 2011)	BYI 02960 (96.2%)	Mallard Duck (<i>Anas platyrhynchos</i>)	NOAEC/LOAEC 845/>845 mg ai/kg-diet	Tested three dietary concentrations; 15 bird pairs/treatment level; birds 19 weeks old at test initiation; 20 week study; no adult mortalities; no significant effects at any test level; percent eggs set of eggs laid was 90.4% (less than 94% required)	POSSIBLE: study should test up to 5,000 mg/kg-diet or until there is a demonstrated reproductive effect
	Avian reproduction, upland game bird species, TGAI	48843720 (Stoughton et al., 2012)	BYI 02960 (96.2%)	Northern Bobwhite Quail (<i>Colinus virginianus</i>)	NOAEC/LOAEC 302/999 mg ai/kg-diet (adult body weight and multiple reproductive endpoints)	Tested three dietary concentrations; 18 bird pairs/treatment level; birds 18 weeks old at test initiation; 23 week study; percent eggs set of eggs laid was 88.7% (less than 97% required)	
850.2400	Wild mammal toxicity	None	N/A	N/A	N/A		
850.2500	Simulated or actual field testing	None	N/A	N/A	N/A		

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
850.1010	Freshwater invertebrate, acute toxicity, TGA1	48843701 (Banman and Lam, 2009)	BYI 02960 (96.2%)	Water Flea <i>Daphnia magna</i>	48-hr EC ₅₀ >77.6 mg ai/L	Limit test; 6 replicates of 5 daphnids each at all levels; static test; no precipitate observed; solvent (DMF) used; no mortalities at limit concentration	
850.1010	Freshwater invertebrate, acute toxicity, TEP	48844509 (Riebschlaeger, 2010)	BYI 02960 SL200G (17.1%)	Water Flea <i>Daphnia magna</i>	48-hr EC ₅₀ 116.3 mg ai/L (684 mg product/L)	Definitive test; static test; 30 daphnids exposed per test level; study author endpoint based on nominal concentrations.	Study triggered due to potential direct application to water.
Non-guideline	Freshwater invertebrate acute toxicity, TGA1	48843738 (Bruns, 2010)	BYI 02960 (96.2%)	Non-biting midge <i>Chironomus riparius</i>	48-hr EC ₅₀ 61.7 µg ai/L	Water column test; definitive test; static test; solvent appears not to have been used; tested 6 concentrations with 4 reps of 10 individual (40 individuals total) per test level	
Non-guideline	Freshwater invertebrate acute toxicity, Degradate	48843739 (Bruns, 2011)	BYI 02960-Succinimide (97.8%)	Non-biting midge <i>Chironomus riparius</i>	48-hr EC ₅₀ >100 mg ai/L	40 individuals per test level; definitive test	
Non-guideline	Freshwater invertebrate acute toxicity, Degradate	48843739 (Bruns, 2011)	BYI 02960-Azabicyclosuccinimide	Non-biting midge <i>Chironomus riparius</i>	48-hr EC ₅₀ >100 mg ai/L	5-concentration static test with 6 reps of 5 organisms per test level.	
850.1025	Estuarine/Marine Mollusk acute toxicity, TGA1	48843703 (Gallagher et al., 2009)	BYI 02960 (96.2%)	Eastern Oyster <i>Crassostrea virginica</i>	96-hr EC ₅₀ >29 mg ai/L*	Study only conducted up to max of 30 mg ai/L in definitive test; however, precipitate was observed at 30 mg ai/L during rangefinder; therefore it is not clear why 30 mg ai/L could be achieved without precipitation of test substance during definitive test; solvent (DMF) was used	POSSIBLE: may not have made sufficient efforts to test at high enough concentrations. Sheepshead minnow acute toxicity study was able to achieve test concentrations up to 83.9 mg ai/L (MRID 48843710)

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
850.1035	Estuarine/Marine crustacean acute toxicity, TGA1	48843704 (Gallagher et al., 2009)	BYI 02960 (96.2%)	Mysid Shrimp <i>Americamysis bahia</i>	96-hr LC ₅₀ 0.26 mg ai/L	Definitive study conducted; static test; test substance appeared to be stable	
850.1035	Estuarine/Marine crustacean acute toxicity, TEP	None	N/A	N/A	N/A		NO: direct application to estuarine/marine environment is not indicated on labels, and TEP is unlikely to move to the estuarine/marine environment
850.1075	Freshwater fish, acute toxicity, TGA1	48843706 (Matlock and Lam, 2010)	BYI 02960 (96.2%)	Fathead Minnow <i>Pimephales promelas</i>	96-hr LC ₅₀ >70.5 mg ai/L*	Definitive study conducted; static test; no precipitate observed; one replicate of 10 fish per test level; tested up to practical limit of solubility; no mortalities observed at any test level; a solvent (DMF) was used; test substance concentrations appeared to be stable	Note: since this endpoint is non-definitive, it cannot be used to calculate acute-to-chronic ratio for estuarine/marine fish chronic endpoint Unclear how only 70.7 mg ai/L test concentration was achieved in this test, while 108 mg ai/L was achieved in test with common carp (MRID 4843707)
	Freshwater fish, acute toxicity, TGA1	48843707 (Bruns, 2011)	BYI 02960 (96.2%)	Common Carp <i>Cyprinus carpio</i>	96-hr LC ₅₀ >108 mg ai/L	Limit test; 30 fish per test level (15 per replicated); no mortalities observed at any test level; static test	
	Freshwater fish, acute toxicity, TEP	48844511 (Bruns, 2011)	BYI 02960 SL200G (17.1%)	Common Carp <i>Cyprinus carpio</i>	96-hr LC ₅₀ >100 mg ai/L (nominal; corrected for % ai)	Limit test; 30 fish per test level	Study triggered due to potential direct application to water.

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
	Freshwater fish, acute toxicity, cold water species, TGA1	48843705 (Matlock and Lam, 2010)	BYI 02960 (96.2%)	Rainbow Trout <i>Oncorhynchus mykiss</i>	96-hr LC ₅₀ >74.2 mg ai/L*	Definitive study conducted; static test; one replicate of 10 fish per test level; tested up to practical limit of solubility; no mortalities observed at any test level; test substance concentrations appeared to be stable	Unclear how only 74.2 mg ai/L test concentration was achieved in this test, while only 108 mg ai/L was achieved in test with common carp (MRID 4843707)
	Freshwater fish, acute toxicity, TEP	48844510 (Bruns, 2010)	BYI 02960 SL200G (17.1%)	Rainbow Trout <i>Oncorhynchus mykiss</i>	96-hr LC ₅₀ >100 mg ai/L (nominal; corrected for % ai)	Limit test; 30 fish per test level; one mortality in group exposed to test substance	POSSIBLE: mortality occurred, may need definitive test according to non-definitive endpoint guidance (however, acute TEP study already available for carp) Study triggered due to potential direct application to water.
	Estuarine/Marine fish acute toxicity, TGA1	48843710 (Banman and Lam, 2009)	BYI 02960 (96.2%)	Sheepshead Minnow <i>Cyprinodon variegatus</i>	96-hr LC ₅₀ >83.9 mg ai/L*	Definitive study conducted; static test; one replicate of 10 fish per test level; tested up to practical limit of solubility; no mortalities observed at any test level; test substance appeared to be stable; no precipitate observed	
850.1300	Freshwater invertebrate, reproduction test, TGA1	48843711 (Riebschlaeger, 2011)	BYI 02960 (96.2%)	Water Flea <i>Daphnia magna</i>	21-day NOAEC/LOAEC 3.2/6.4 mg ai/L (parental body length)	Static renewal test; water quality parameters and test substance concentration appeared stable; ten individuals per test level (6 concentrations plus negative and solvent controls)	

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
850.1350	Estuarine/marine invertebrate, reproduction test, TGA1	48843713 (Claude, 2011)	BYI 02960 (96.2%)	Mysid Shrimp <i>Americamysis bahia</i>	28-day NOAEC/LOAEC 13.2/23.6 µg ai/L (number of young per reproductive day)	Flow-through test; some sublethal effects and mortalities in replicate that study authors claim was not treatment-related; control first generation survival to pairing ≥95% and to test termination ≥83%; water quality measurements appear stable	
850.1400	Freshwater fish, early life stage test, TGA1	48843714 (Matlock and Lam, 2011)	BYI 02960 (96.2%)	Fathead Minnow <i>Pimephales promelas</i>	35-day NOAEC/LOAEC 4.41/8.40 mg ai/L (fry survival)	Flow-through test; test concentration and water quality measurements appear stable	
	Saltwater fish, early life stage test, TGA1	None	N/A	N/A	N/A		YES: parent is stable in water and mobile and therefore could reach the estuarine/marine environment; since fathead minnow acute toxicity endpoint is non-definitive, it cannot be used to calculate acute-to-chronic ratio for estuarine/marine fish chronic endpoint
850.1500	Freshwater fish life cycle test, TGA1	None	N/A	N/A	N/A		POSSIBLE: at least one product could be applied direct to water (cranberries); also reproductive effects to fish in ELS study
	Estuarine/marine Fish life cycle test	None	N/A	N/A	N/A		
850.1735	Whole sediment 10-d freshwater invertebrate	None	N/A	N/A	N/A		NO: Kow <3; Kd <50; Koc <1000
850.1740	Whole sediment 10-d estuarine/marine invertebrate	None	N/A	N/A	N/A		NO: Kow <3; Kd <50; Koc <1000

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
Agency-wide guideline	Whole sediment chronic freshwater and/or marine invertebrate	None	N/A	N/A	N/A		NO: Kow <3; Kd <50; Koc <1000
850.1950	Simulated or actual field testing for aquatic organisms	None	N/A	N/A	N/A		
OECD TG 219	28-day Sediment Toxicity Test, TGA1	48843741 (Bruns, 2011)	BY1 02960 (96.2%)	Non-biting Midge <i>Chironomus riparius</i>	28-day EC ₅₀ 21.8 µg ai/L (emergence rate) NOAEC/LOAEC 10.5/21.3 µg ai/L (emergence rate, development rate)	Used spiked water; pooled controls for statistical analyses; results based on initial measured test substance concentrations; final test concentrations were substantially lower than initial; 4 replicates of 20 larvae per test level.	
OECD TG 219	28-day Sediment Toxicity Test, Degradate	48843742 (Bruns, 2011)	Sodium Diflouroacetate (99%)	Non-biting Midge <i>Chironomus riparius</i>	28-day NOAEC/LOAEC 100/>100 µg ai/L	Limit test; 6 reps of 2 animals each per test level; no effects observed at limit concentration; results based on nominal initial concentrations	
OECD TG 219	28-day Sediment Toxicity Test, Degradate	48843743 (Bruns, 2011)	6-Chloronicotinic acid	Non-biting Midge <i>Chironomus riparius</i>	28-day NOAEC/LOAEC 100/>100 µg ai/L	Limit test; 6 reps of 2 animals each per test level; no effects observed at limit concentration; results based on nominal initial concentrations	
OECD TG 219	28-day Sediment Toxicity Test, TEP	48844519 (Silke, 2011)	BY1 02960 SL200G (17.1%)	Non-biting Midge <i>Chironomus riparius</i>	28-day EC ₅₀ 21.5 µg ai/L (emergence rate) NOAEC/LOAEC 12/24 µg ai/L (emergence rate, development rate)	Appears similar in toxicity to technical when corrected for % active ingredient	

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
850.3020	Honeybee acute contact and oral toxicity, TGA1	48843722 (Schmitzer, 2008)	BYI 02960 (99.5%)	Honeybee <i>Apis mellifera</i>	Contact: 96-hr LD ₅₀ 122.8 µg ai/bee Oral: 48-hr LD ₅₀ 1.2 µg ai/bee	Both contact and oral studies tested 30 bees per treatment level and had <20% mortality in controls.	
	Honeybee acute contact and oral toxicity, Degradate	48843723 (Schmitzer, 2010)	BYI0296 - difluoroethyl- amino- furanone (99.2%)	Honeybee <i>Apis mellifera</i>	Contact: 48-hr LD ₅₀ >100 µg ai/bee Oral: 48-hr LD ₅₀ >85 µg ai/bee	Both contact and oral studies tested 30 bees per treatment level and had <20% mortality in controls; may not have tested high enough (<i>i.e.</i> , up to environmentally relevant concentrations)	
	Honeybee acute contact and oral toxicity, Degradate	48843724 (Schmitzer, 2011)	BYI 02960- hydroxy (95.5%)	Honeybee <i>Apis mellifera</i>	Contact: 48-hr LD ₅₀ >100 µg ai/bee Oral: 48-hr LD ₅₀ >105.3 µg ai/bee	Both contact and oral studies tested were limit tests and had 50 bees per treatment level and had <20% mortality in controls; may not have tested high enough (<i>i.e.</i> , up to environmentally relevant concentrations)	
	Honeybee acute contact and oral toxicity, Degradate	48843725 (Schmitzer, 2010)	Difluoroacetic acid (95.8%)	Honeybee <i>Apis mellifera</i>	Contact: 48-hr LD ₅₀ >100 µg ai/bee Oral: 48-hr LD ₅₀ >107.9 µg ai/bee	Both contact and oral studies tested were limit tests and had 50 bees per treatment level and had <20% mortality in controls; may not have tested high enough (<i>i.e.</i> , up to environmentally relevant concentrations)	POSSIBLE: if this is deemed a necessary study, more data may be needed since two bees died at the limit dose
	Honeybee acute contact and oral toxicity, Degradate	48843726 (Schmitzer, 2010)	6- chloronicotinic acid - AE F161089, (98.8%)	Honeybee <i>Apis mellifera</i>	Contact: 48-hr LD ₅₀ >100 µg ai/bee Oral: 48-hr LD ₅₀ >107.1 µg ai/bee	Both contact and oral studies tested were limit tests and had 50 bees per treatment level and had <20% mortality in controls; may not have tested high enough (<i>i.e.</i> , up to environmentally relevant concentrations)	

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
	Honeybee acute contact and oral toxicity, Degradate	48843727 (Schmitzer, 2010)	6-chloro-picolylalcohol (98.95)	Honeybee <i>Apis mellifera</i>	Contact: 48-hr LD ₅₀ >100 µg ai/bee Oral: 48-hr LD ₅₀ >106.7 µg ai/bee	Both contact and oral studies tested were limit tests and had 50 bees per treatment level and had <20% mortality in controls; may not have tested high enough (<i>i.e.</i> , up to environmentally relevant concentrations)	
	Honeybee acute contact and oral toxicity—TEP	4844514 (Schmitzer, 2009)	BYI 02960 SL200G (17.0%)	Honeybee <i>Apis mellifera</i>	Contact: 72-hr LD ₅₀ 15.7 µg ai/bee Oral: 48-hr LD ₅₀ 3.2 µg ai/bee	Both contact and oral studies tested 30 bees per treatment level and had <20% mortality in controls; may not have tested high enough (<i>i.e.</i> , up to environmentally relevant concentrations); toxicity values are corrected for % active ingredient	
	Honeybee acute contact and oral toxicity—TEP	4844515 (Schmitzer, 2010)	BYI 02960 SL 200 G (17.0%) + Tebuconazole EW 250C G (25.4%)	Honeybee <i>Apis mellifera</i>	Contact: 72-hr LD ₅₀ 1.0 µg ai/bee Oral: 48-hr LD ₅₀ 0.2 µg ai/bee	Both contact and oral studies tested 30 bees per treatment level and had <20% mortality in controls; may not have tested high enough (<i>i.e.</i> , up to environmentally relevant concentrations); toxicity values are corrected for % active ingredient	
	Honeybee acute contact and oral toxicity—TEP	48844711 Schmitzer, 2011)	BYI 02960 FS480G	Honeybee <i>Apis mellifera</i>	Contact: 96-hr LD ₅₀ 68.6 µg ai/bee Oral: 48-hr LD ₅₀ 3.4 µg ai/bee	Both contact and oral studies tested 30 bees per treatment level and had <20% mortality in controls; may not have tested high enough (<i>i.e.</i> , up to environmentally relevant concentrations); toxicity values are corrected for % active ingredient	
850.3030	Honeybee toxicity of residues on foliage, TEP	48843728 (Porch and Krueger, 2011)	BYI 02960 SL 200 (39.9%)	Honeybee <i>Apis mellifera</i>	RT ₂₅ < 3 hours	Tested application rate of 1.025 L product/ha (205 g ai/ha); 6 reps of 25 bees (150 total bees) for control, 3, 8, and 24 hr retreatment intervals	POSSIBLE: did not test up to maximum single application rate of 401 g ai/ha

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
850.3040	Field testing for pollinators, TEP	48844516 (Rexer, 2012)	BY1 02960 FS480G and SL200G (sequentially)	Honeybee <i>Apis mellifera</i>	Not screened	Study investigates effects to honeybees exposed to winter oil-seed rape grown from treated seeds in Northern Germany	
		48844517 (Rexer, 2012)	BY1 02960 FS480G and SL200G (sequentially)	Honeybee <i>Apis mellifera</i>	Not screened	Study investigates effects to honeybees exposed to winter oil-seed rape grown from treated seeds in France	
Non-guideline	10-day chronic laboratory feeding study, TGA1	48843762 (Kling, 2011)	BY1 02960 (96.2%)	Honeybee <i>Apis mellifera</i>	10-day NOAEC/LOAEC 10000/>10000 µg ai/L (mortality)	Young adult worker bees exposed to sucrose solution containing test substance, and mortality, sublethal effects, and behavior were observed for 10 days; 10 replicates of 10 bees in treated animals, and 30 replicates of 10 bees in control group; 10-day mortality at concentrations ranging from 100 to 10000 µg ai/L; food consumption effected at 300 µg ai/L; control contained acetone and no true negative control appears to have been run	
Non-guideline	10-day chronic laboratory feeding study, degradate	48843763 (Kling, 2012)	BY1 02960- difluoroethyl- amino- furanone (98.9%)	Honeybee <i>Apis mellifera</i>	10-day NOAEC/LOAEC 10000/>10000 µg ai/L (mortality)	Limit test; young adult worker bees exposed to sucrose solution containing test substance, and mortality, sublethal effects, and behavior were observed for 10 days; 10 replicates of 10 bees in treated animals, and 30 replicates of 10 bees in control group; 10-day mortality at limit concentrations ranging of 10000 µg ai/L; control contained acetone and no true negative control appears to have been run	

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
Non-guideline	10-day chronic laboratory feeding study, degradate	48843764 (Kling, 2012)	BYI 02960-hydroxy (95.5%)	Honeybee <i>Apis mellifera</i>	10-day NOAEC/LOAEC 10000/>10000 µg ai/L (mortality)	Limit test; young adult worker bees exposed to sucrose solution containing test substance, and mortality, sublethal effects, and behavior were observed for 10 days; 10 replicates of 10 bees in treated animals, and 30 replicates of 10 bees in control group; 10-day mortality at limit concentrations ranging of 10000 µg ai/L; control contained acetone and no true negative control appears to have been run	
Non-guideline	10-day chronic laboratory feeding study, degradate	48843765 (Kling, 2012)	Difluoroacetic acid (95.8%)	Honeybee <i>Apis mellifera</i>	10-day NOAEC/LOAEC 10000/>10000 µg ai/L (mortality)	Limit test; young adult worker bees exposed to sucrose solution containing test substance, and mortality, sublethal effects, and behavior were observed for 10 days; 10 replicates of 10 bees in treated animals, and 30 replicates of 10 bees in control group; 10-day mortality at limit concentrations ranging of 10000 µg ai/L; control contained acetone and no true negative control appears to have been run	

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
Non-guideline	10-day chronic laboratory feeding study, degradate	48843766 (Kling, 2012)	6-chloronicotinic acid (98.8%)	Honeybee <i>Apis mellifera</i>	10-day NOAEC/LOAEC 10000/>10000 µg ai/L (mortality)	Limit test; young adult worker bees exposed to sucrose solution containing test substance, and mortality, sublethal effects, and behavior were observed for 10 days; 10 replicates of 10 bees in treated animals, and 30 replicates of 10 bees in control group; 10-day mortality at limit concentrations ranging of 10000 µg ai/L; control contained acetone and no true negative control appears to have been run	
Non-guideline	10-day chronic laboratory feeding study, degradate	48843767 (Kling, 2012)	6-chloropicolyl alcohol (99.4%)	Honeybee <i>Apis mellifera</i>	10-day NOAEC/LOAEC 10000/>10000 µg ai/L (mortality)	Limit test; young adult worker bees exposed to sucrose solution containing test substance, and mortality, sublethal effects, and behavior were observed for 10 days; 10 replicates of 10 bees in treated animals, and 30 replicates of 10 bees in control group; 10-day mortality at limit concentrations ranging of 10000 µg ai/L; control contained acetone and no true negative control appears to have been run	
Non-guideline	Honeybee larval toxicity study with spiked diet, TGA1	48843768 (Nikolakis et. Al, 2011)	BYI 02960 (96.2%)	Honeybee <i>Apis mellifera</i>	NOAEC/LOAEC 10000/>10000 µg ai/kg-diet (mortality)	First instar larvae were artificial fed in laboratory on spiked diet; study performed under 2008 INRA recommendations and ICBPR ring test group	
Non-guideline	Honeybee semi-field colony feeding study	48843771 (Nikolakis et. Al, 2012)	BYI 02960 (96.2%)	Honeybee <i>Apis mellifera</i>	Not screened	Not screened	

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
850.4100	Seedling emergence, TEP	48843729 (Gosch, 2010)	BYI 02960 200 SL (17%)	<i>Beta vulgaris</i> (Sugar beet), <i>Brassica napus</i> (Oilseed rape), <i>Cucumis sativus</i> (Cucumber), <i>Fagopyrum esculentum</i> (Buckwheat), <i>Glycine max</i> (Soybean), <i>Lactuca sativa</i> (Lettuce), <i>Lycopersicon esculentum</i> (Tomato), <i>Allium cepa</i> (Onion), <i>Avena sativa</i> (Oat), <i>Lolium perenne</i> (Ryegrass), <i>Zea mays</i> (Corn)	21-day EC ₂₅ >410g ai/ha NOAEC/LOAEC 410/>410 g ai/ha	Used 11 species (seven dicotyledonous and four monocotyledonous species); single application rate tested (Tier I) of 410 g ai/ha (2.4 kg-product/ha; 8 replicates of 5 seeds (40 seeds total) per test level; no species exhibited >25% inhibition of emergence, seedling survival, visual phytotoxicity, growth, shoot length and shoot dry weight; <i>Fagopyrum esculentum</i> was the most sensitive species for shoot length and shoot dry weight, with a 13.8% respectively 19.7% reduction which were both statistically significant; onion had poor emergence rate (75%)	

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
850.4150	Vegetative vigor, TEP	48843730 (Gosch, 2010)	BYI 02960 200 SL (17%)	<i>Beta vulgaris</i> (Sugar beet), <i>Brassica napus</i> (Oilseed rape), <i>Cucumis sativus</i> (Cucumber), <i>Fagopyrum esculentum</i> (Buckwheat), <i>Glycine max</i> (Soybean), <i>Lactuca sativa</i> (Lettuce), <i>Lycopersicon esculentum</i> (Tomato), <i>Allium cepa</i> (Onion), <i>Avena sativa</i> (Oat), <i>Lolium perenne</i> (Ryegrass), <i>Zea mays</i> (Corn)	21-day EC ₂₅ >410 g ai/ha NOAEC/LOAEC 410/>410 g ai/ha	Used 11 species (seven dicotyledonous and four monocotyledonous species); single application rate tested (Tier I) of 410 g ai/ha (2.4 kg-product/ha; 8 replicates of 4 seeds (32 seeds total) per test level; no species exhibited >25% inhibition of survival, visual phytotoxicity, growth, shoot length and shoot dry weight; buck wheat was the most sensitive species for shoot dry weight, with a 12% reduction which was statistically significant	
850.4400	Aquatic plant, vascular plant, TGA1	48843731 (Banman et al., 2010)	BYI 02960 (96.2%)	Duckweed <i>Lemna gibba</i>	7-day EC ₅₀ >67.6 mg ai/L NOAEC/LOAEC 34.2/67.7 mg ai/L (frond count, biomass, growth rate)	Static renewal test; definitive test; conducted up to functional limit of solubility of 80 mg ai/L (67.7 mg ai/L measured); significant effects to frond count, cumulative biomass, and growth rate at highest concentration (67.7 mg ai/L)	
850.4500	Aquatic Plant, freshwater green alga species, TGA1	48843732 (Banman and Lam, 2010)	BYI 02960 (96.2%)	Green algae <i>Pseudokirchneriella subcapitata</i>	96-hr EC ₅₀ >80 mg ai/L NOAEC/LOAEC 80/>80 mg ai/L	Static test; limit test; conducted at functional limit of solubility of 80 mg ai/L (95 mg ai/L measured); based endpoints on nominal test concentrations since study authors state that recovery was 114-119% of nominal; initial cell count of 10,000	

Guideline	Description	MRID(s)	Test Substance	Common Name (Species)	Preliminary Endpoint	Study Issues/Comments	Additional Data Needed?
850.4500	Aquatic Plant, freshwater green alga species, TGA1	48844518 (Bruns, 2010)	BYI 02960 SL200G (17.1%)	Green algae <i>Pseudokirchneriella subcapitata</i>	72-hr EC ₅₀ >42.5 mg ai/L NOAEC/LOAEC 42.5/>42.5 mg ai/L (corrected for % ai)*	Static test; definitive test; endpoints based on nominal concentrations; endpoints corrected for % active ingredient in formulation	Test length should be 96 hours
850.4500	Tier II Aquatic Plant, freshwater diatom, TGA1	None	N/A	N/A	N/A	N/A	YES: data are generally required for a freshwater diatom, marine diatom, and cyanobacterium
850.4500	Tier I Aquatic Plant, marine diatom, TGA1	N/A	N/A	N/A	N/A	N/A	YES: data are generally required for a freshwater diatom, marine diatom, and cyanobacterium
850.4550	Tier II Aquatic Plant, cyanobacterium, TGA1	N/A	N/A	N/A	N/A	N/A	YES: data are generally required for a freshwater diatom, marine diatom, and cyanobacterium
* The practical level of solubility of flupyradifurone technical in several aquatic studies (including limit tests) was much lower than the demonstrated water solubility of 3.2 g/L; therefore, during formal review of these studies, the methods used to establish the practical level of solubility will be further examined to determine if studies tested up to high enough concentrations.							

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